

# KTU-GEOD IVS Analysis Center Biennial Report (2015–2016)

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**Abstract** This report summarizes the activities of the KTU-GEOD IVS Analysis Center (AC) in 2015 and 2016 and outlines the planned activities for the years 2017 and 2018. Estimating the parameter UT1-UTC from the observations of IVS [1] Intensive sessions with VieVS [2] and comparison of ITRF2014 [3] station coordinate input time series of VLBI [1], GNSS [4], and DORIS [5], are our specific interests for 2015 and 2016.

## 1 General Information

In 2016, two graduate students have been added to our group. They are Ms. Özge Karaaslan (PhD student) and Mr. Mehmet Fikret Öcal (MSc student). Ms. Özge Karaaslan will be working on the comparison of parameter estimation results in VLBI (Very Long Baseline Interferometry) data analysis performed by Kalman Filter (KF) and classical Least Squares Method (LSM). Mr. Mehmet Fikret Öcal will estimate UT1-UTC using Vienna VLBI Software, VieVS [2] to analyze the observations of the IVS Intensive sessions, and he will compare the VLBI results to those from GNSS, e.g. IGS [6]. A new Geodesy Lab was built up at Hacettepe University with the present capacity of analyzing VLBI and GNSS sessions using VieVS [2] and Bernese Software [7] running on a Linux (Ubuntu V14, LTS: Long Term Support) operating system.

1. Karadeniz Technical University, Department of Geomatics Engineering

2. Hacettepe University, Department of Geomatics Engineering

KTU-GEOD Analysis Center

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One of the targets of the Geodesy Lab at Hacettepe University is to support the KTU-GEOD IVS AC through close co-operation with the VIE AC at the Vienna University of Technology (TU Wien).

## 2 Staff at KTU-GEOD Contributing to the IVS Analysis Center

Members of the KTU-GEOD IVS Analysis Center (AC) are listed in Table 1 (in alphabetical order) with their main focus of research and working location [8, 9]:

**Table 1** Staff.

Name	Working Location	Main Focus of Research
Emine Tanır Kayıkçı	Karadeniz Technical Univ., Dept. of Geomatics Eng., Trabzon, Turkey	responsible person from AC, parameter combination
Kamil Teke	Hacettepe Univ., Dept. of Geomatics Eng., Ankara, Turkey	troposphere
Mehmet Fikret Öcal	Hacettepe Univ., Dept. of Geomatics Eng., Ankara, Turkey	data analysis, signal processing
Özge Karaaslan	Karadeniz Technical Univ., Dept. of Geomatics Eng., Trabzon, Turkey	data analysis, parameter estimation



**Fig. 1** Members of the KTU-GEOD IVS Analysis Center (AC) participated in the Seventh VieVS [2] User Workshop, which was held in Vienna in 2016.

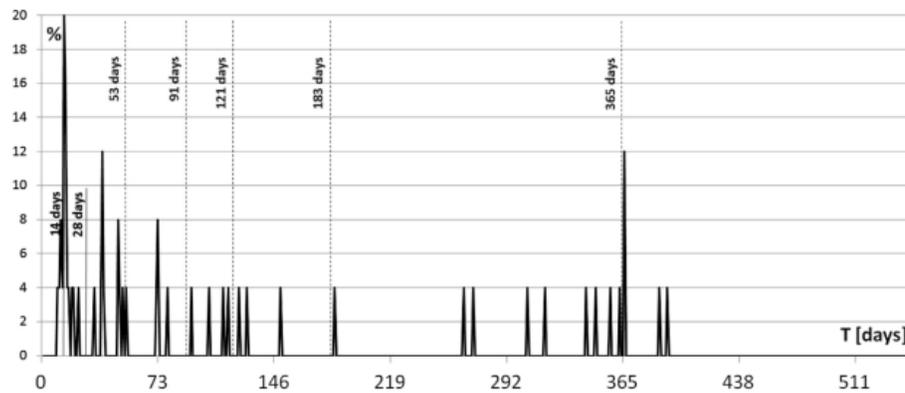
### 3 Current Status and Activities

During 2015 and 2016, we continued working on inter-technique comparisons of different parameters estimated from the observations of the satellite/space geodetic techniques, i.e., GNSS (Global Navigation Satellite Systems, [4]), VLBI (Very Long Baseline Interferometry, [1]), and DORIS (Doppler Orbitography and Radio Positioning Integrated by Satellite, [5]). In 2014, we had compared troposphere zenith total delays (ZTD) and horizontal total gradients derived from IGS and IVS co-located sites [10]. During the last two years, with the collaboration of Dr. Vincenza Tornatore as the PMD (Politecnico di Milano) AC's team coordinator, we have compared site position time series extracted from combined solutions submitted by three official Combination Centers (CCs) belonging to IVS, IGS, and IDS that have contributed to the realization of the International Terrestrial Reference Frame 2014 (ITRF2014, [3, 11]). In particular the height component time series extracted from official combined intra-technique solutions submitted for ITRF2014 by VLBI, GNSS, and DORIS Combination Centers have been investigated to assess the level of agreement among these three space-geodetic techniques. The estimated velocities and their standard deviations for the sites that co-located the VLBI, GNSS, and DORIS stations were compared.

With the call [12] for participation for the computation of ITRF2014, ACs belonging to individual geode-

tic services of the IVS, IGS, and IDS reprocessed solutions according to common guidelines in the IERS Conventions 2010 [13]. In this work, harmonic analysis was carried out on the geodetic discrete irregular sampled time series residuals by using the software Frequency Analysis Mapping On Unusual Sampling (FAMOUS) developed by [14]. The IVS Up component time series analyzed in this work is derived from the combined solution calculated for ITRF2014. This combined solution is named as *ivs2014a*. 25 sites, at least five years of observations, and at least two sessions per month were chosen for analysis. For these sites, eight discontinuities in the Up direction were detected and removed. Two classes of signals related to seasonal (represented with dashed lines) and tidal effects (continuous lines) were detected (Figure 2).

During 2015 and 2016, we also analyzed several IVS Intensive sessions through reducing GNSS troposphere zenith total delays and horizontal total gradients from VLBI observations a priori to the parameter estimation with the collaboration of the Vienna AC working group at the Vienna University of Technology (TU Wien). We found slight improvement of the agreement of the length of day (LOD) with that from IGS [6] when east horizontal total gradients are reduced a priori from the observations of the IVS Intensive sessions [15].



**Fig. 2** Percentage of VLBI sites where a signal of period  $T$  is detected. (The periods of the expected tidal (—) and solar (---) harmonics are evidenced).

## 4 Future Plans

In 2017 and 2018, our group will be working on the comparison of the VLBI parameter estimation results from data analysis performed by Kalman Filter (KF) and classical Least Squares Method (LSM), and we will continue to investigate UT1-UTC from IVS Intensive sessions.

## Acknowledgements

We are thankful to all the governing board of IVS. We are grateful to Karadeniz Technical University, Hacettepe University, and TU Wien for providing financial, technical and/or scientific support to KTU-GEOD IVS AC research activities.

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